



# ***GPM***

## ***Global Precipitation Measurement***

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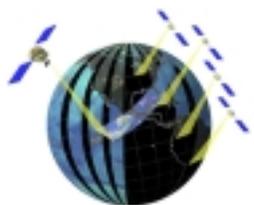
### ***Planning for Global Precipitation Measurement***

***IGARSS 2001 - International Geoscience and Remote Sensing Symposium  
Special Session 30, Paper 357.00***



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**GPM**

# ***GPM Feb '01 Reference Concept***

***OBJECTIVE: Understand the Horizontal and Vertical Structure of Rainfall and Its Microphysical Element. Provide Training for Constellation Radiometers.***

***OBJECTIVE: Provide Enough Sampling to Reduce Uncertainty in Short-term Rainfall Accumulations. Extend Scientific and Societal Applications.***

## **Core Satellite**

- ***Dual Frequency Radar***
- ***Multi-frequency Radiometer***
- ***H2-A Launch***
- ***TRMM-like Spacecraft***
- ***Non-Sun Synchronous Orbit***
- ***~65° Inclination***
- ***~400 - 500 km Altitude***
- ***~4 km Horizontal Resolution (Maximum)***
- ***250 m Vertical Resolution***

## **Precipitation Validation Sites**

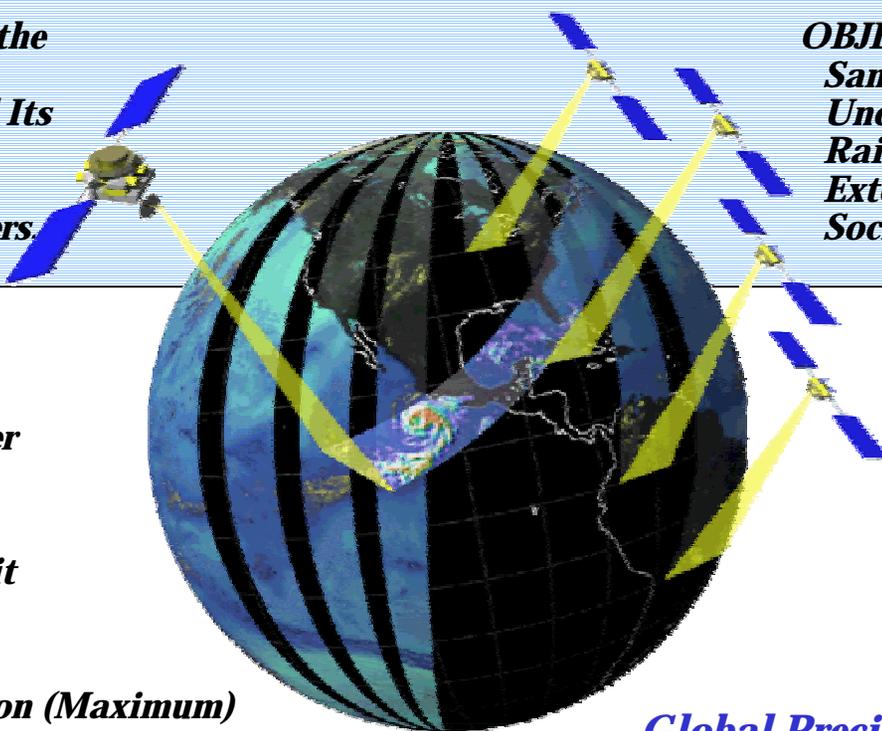
- ***Global Ground Based Rain Measurement***

## **Constellation Satellites**

- ***Multiple Satellites with Microwave Radiometers***
- ***Aggregate Revisit Time, 3 Hour goal***
- ***Sun-Synchronous Polar Orbits***
- ***~600 km Altitude***

## **Global Precipitation Processing Center**

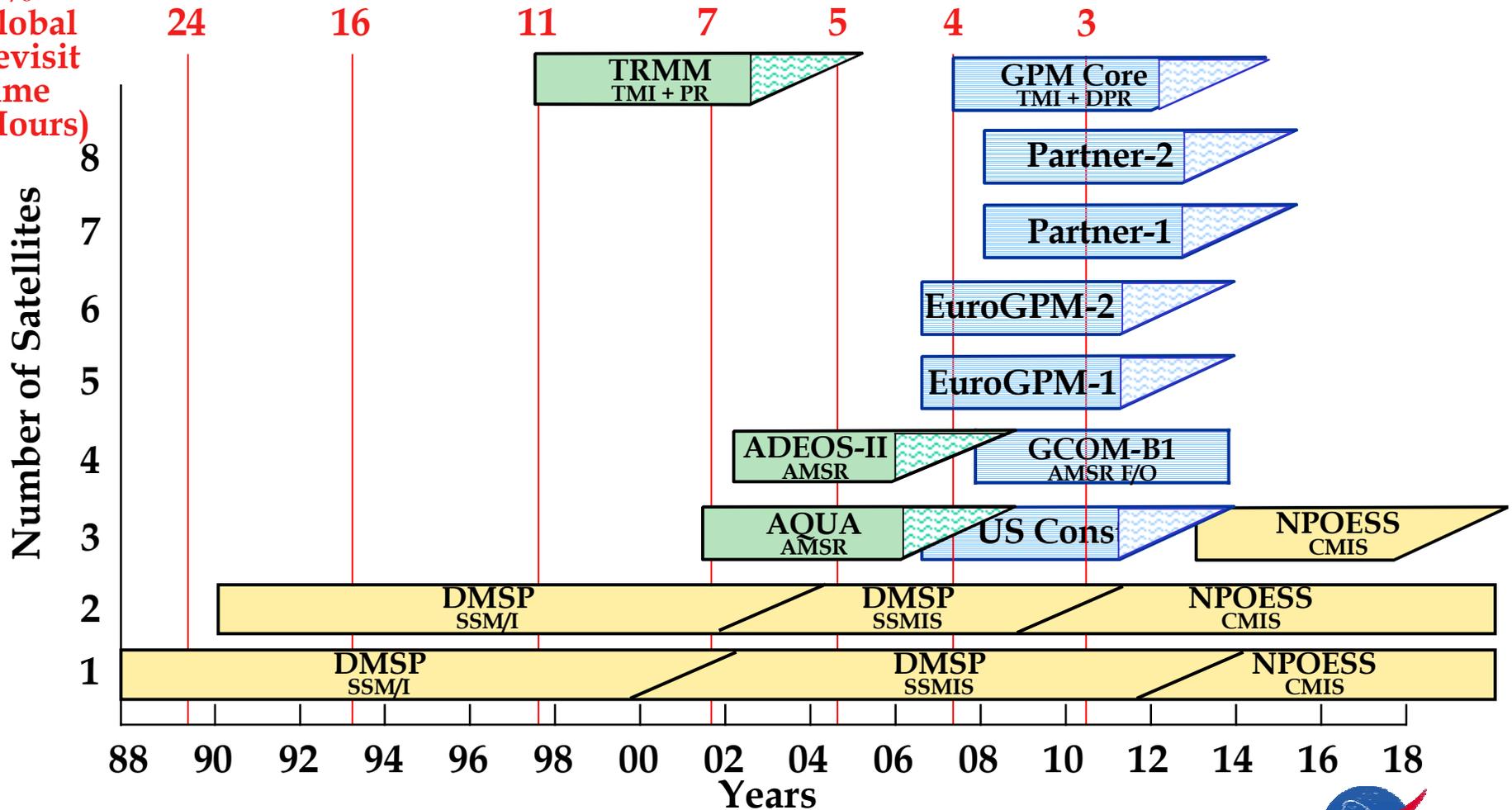
- ***Capable of Producing Global Precip Data Products as Defined by GPM Partners***





# Evolution of International Precipitation Satellite Constellation

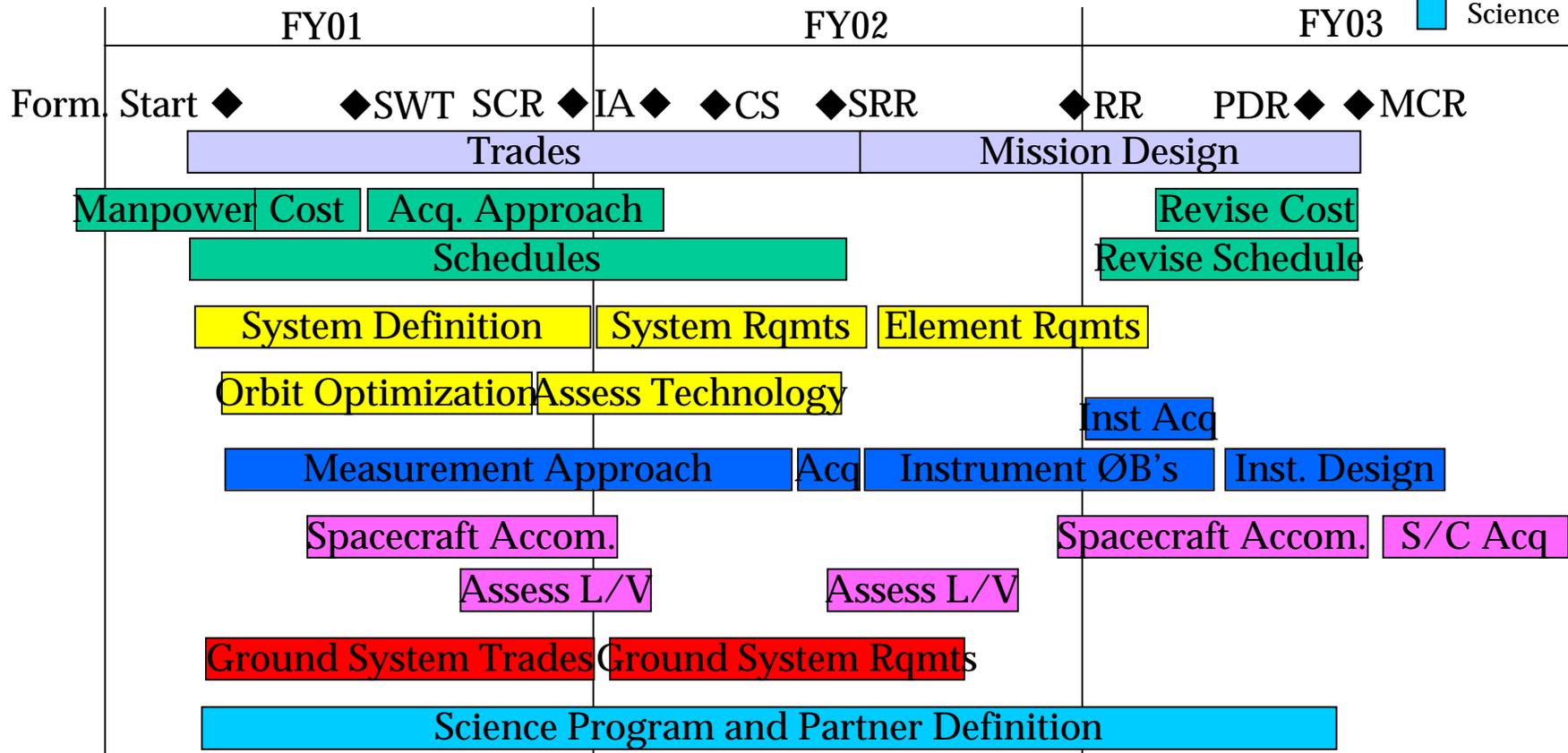
90%  
Global  
Revisit  
Time  
(Hours)





# Formulation Plan

- Mission
- Project
- Systems
- Measurement
- Spacecraft
- Gnd/Data Sys.
- Science



## Milestone Abbreviations:

SWT - Science Working Team  
 SCR - System Concept Review  
 IA - Independent Assessment  
 CS - Concept Selection

SRR - System Requirements Review  
 RR - Receiving Review  
 PDR - Preliminary Design Review  
 MCR - Mission Confirmation Review

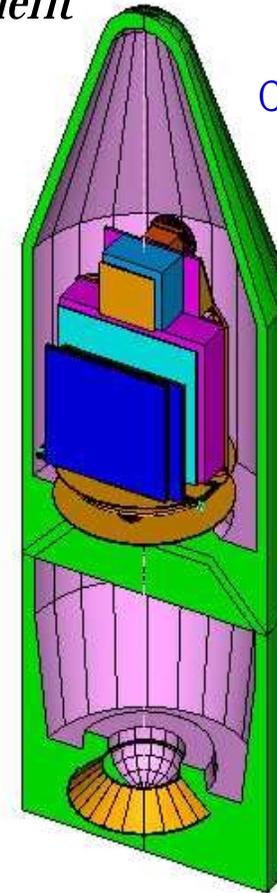


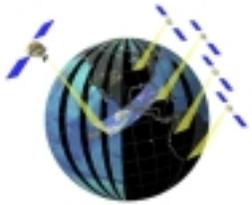


# ***GPM Trade Space***

- *Science Requirements & Partnership Development*
- *Systems Engineering & Systems Effectiveness*
- *Mission Architecture*
- *Measurement Approach*
  - *Radiometer(s)*
  - *Radar*
- *Ground and Data System*
- *Programmatic Considerations*

H2-A  
Dual Launch  
Configuration

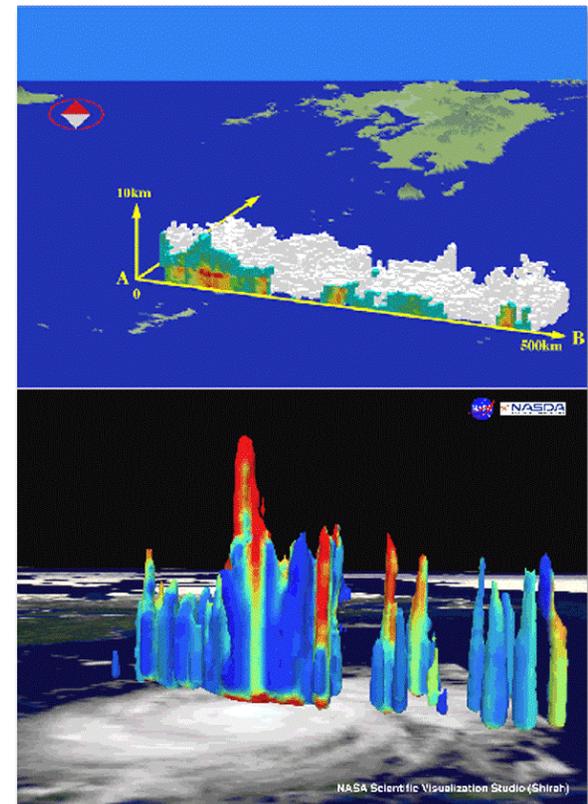


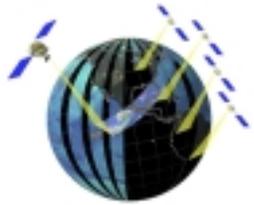


# *Science Formulation Activities*

## GPM

- *Encourage Participation via Workshops, AO's & Colloquia*
  - *SWT Meetings, International Workshops*
  - *GPM Seminars*
- *Refine Primary Science Requirements*
- *Systematic Measurement Approach*
  - *Future Mission Scope Definition*
  - *Developing Operational Agency Involvement*
  - *Technology Roadmaps and Infusion Approaches*
- *Sensitivity Studies in Support of Trades*
  - *Define Impact of Data Gap's*
  - *Assess Radiometer Approach*

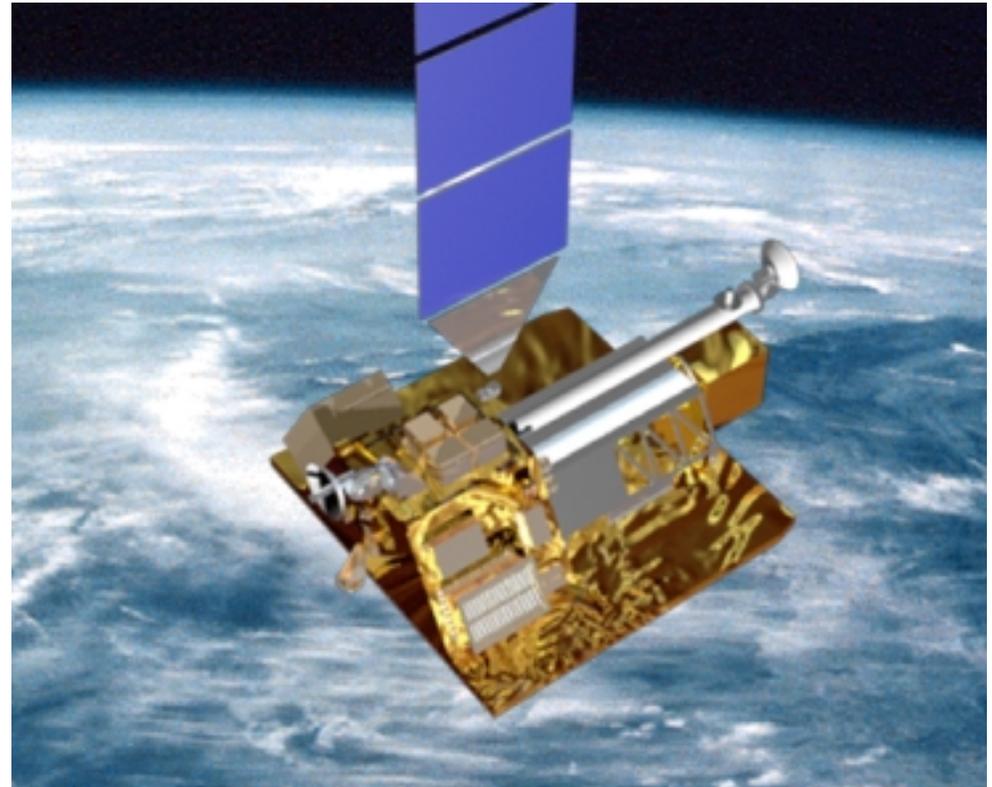




**GPM**

# *Measurement Approach Trades*

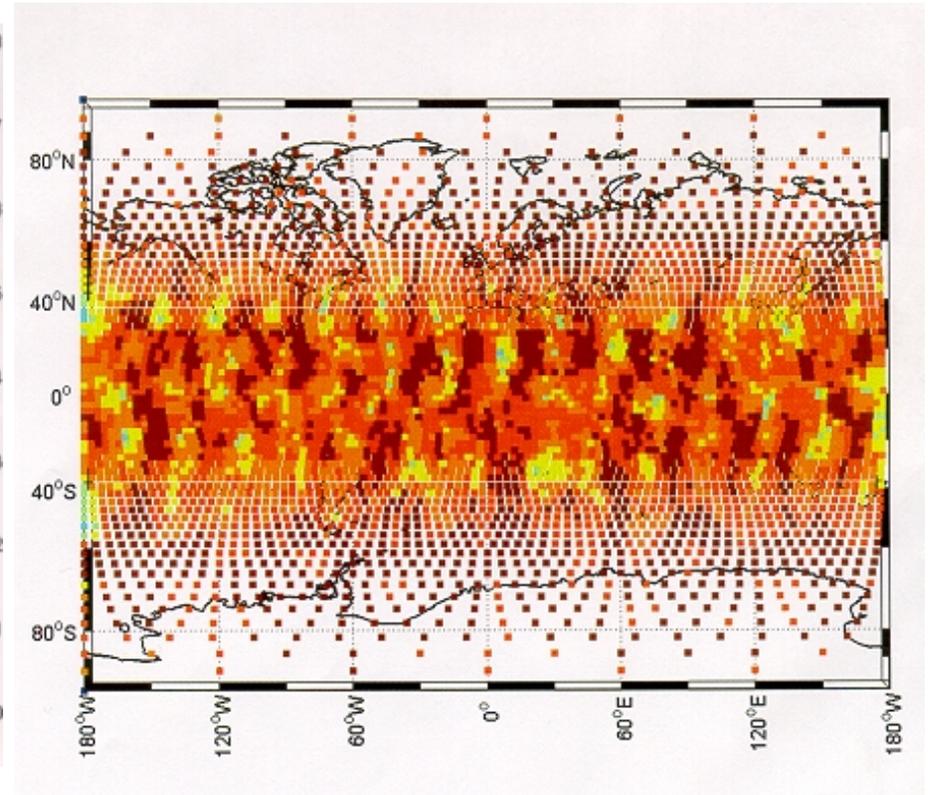
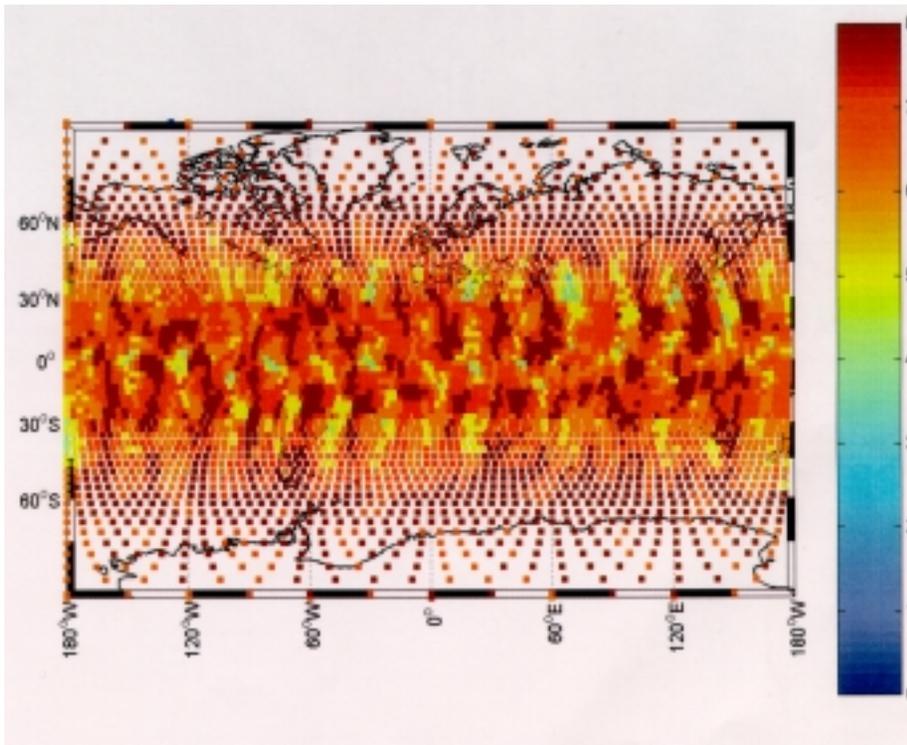
- *Radiometer(s)*
  - *Frequencies*
    - *10.7, 19, 22, 37, 85, 150?*
  - *Scan Method*
    - *Conical vs Cross Track*
  - *Antenna Size*
    - *Orbit Altitude*
    - *Spatial Resolution*
    - *Cost & Complexity*
  - *Technology Readiness Assessment*
    - *eg TMI, SSMI/S, CMIS, CMR/STAR*
- *Radar*
  - *Accommodations*
  - *Technology Readiness Assessment*





# *Number of 3-Hour Intervals Sampled on Two Different Days*

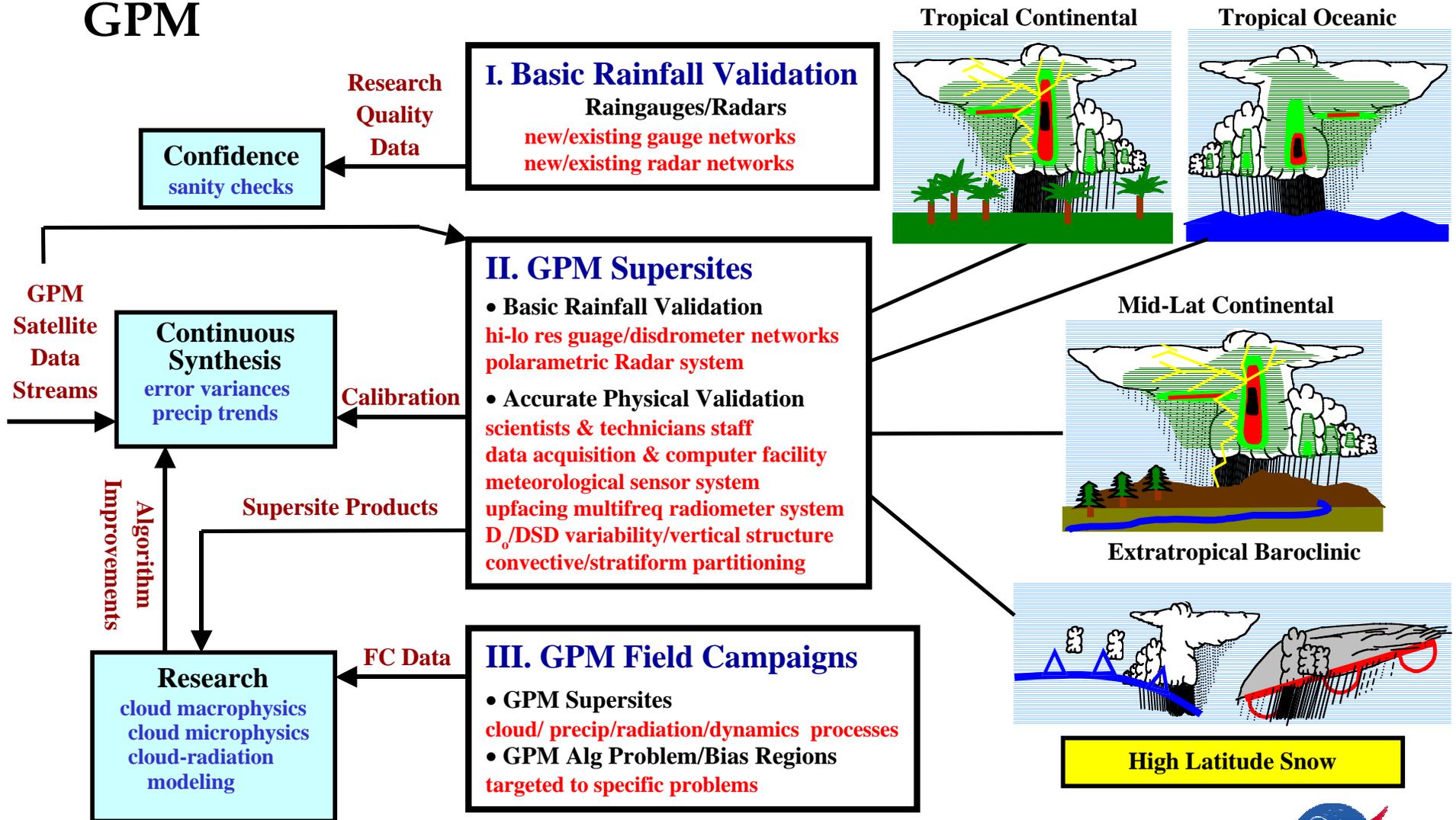
*Precipitation Sampling Worldwide  
Constant Area Pixels*



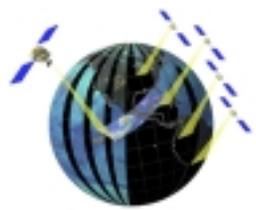
*CORE, DMSP-F18, DMSP-F19, Megha-Tropiques, GCOM-B1,  
and Three 600 km Drones @ 34°, 84°, and 90°*



# GPM Validation Strategy

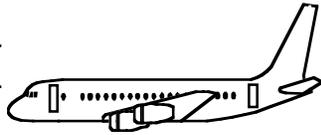


# Supersite Template



GPM

*Focused Field Campaigns*



GPM Core Satellite  
Radar/Radiometer  
Prototype Instruments

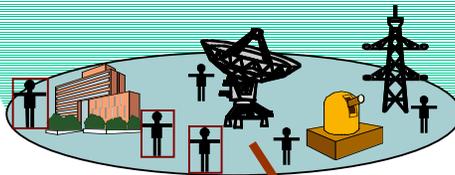
Piloted



UAVs



Meteorology-Microphysics  
Aircraft

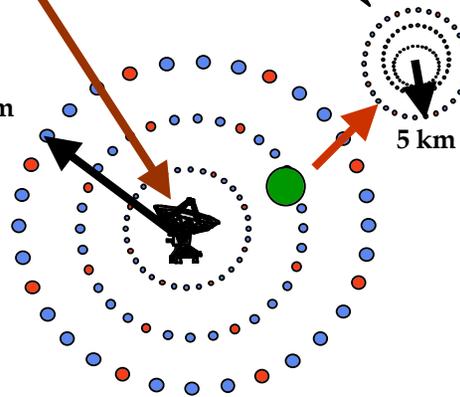


150 km

150 km

● Triple Gage Site  
(3 economy scientific gages)

● Single Disdrometer/  
Triple Gage Site  
(1 high quality-Large Aperature/  
2 economy scientific gages)



**DELIVERY**

## Legend



Data Acquisition-  
Analysis Facility



Multiparameter Radar



Uplink Radiometer/Radar  
940 MHz Profiler  
Port X-band Radar



Meteorological Tower



Site Scientist (3)



Technician (3)

Retrieval Error  
Synthesis

Algorithm  
Improvement  
Guidance

Validation Analysis

**50-Gage Site Hi-Res Domain**  
Center-Displaced with  
Uplinking Radiometer / Radar System  
[10.7,19,22,37,85,150 GHz/14,35,95 GHz]  
915 or 2835 MHz doppler Radar Profiler  
Portable X-band Radar

**100-Gage Site Lo-Res Domain**  
Centered on Multi-param-Radar





# *Conclusions*

- *GPM is a NASA Funded Program*
  - *Currently in Advance Study*
  - *Starts Formulation (Phase B) in October 2001*
- *GPM considers Validation part of the measurement and thus a dedicated mission segment*
- *GPM Performance Depend upon Successful Partnerships*
  - *Space Segment*
  - *Ground Segment*
  - *Validation Segment*
  - *Research Segment*